TAG AXLE ASSEMBLY

BACKGROUND OF THE INVENTION

[1] This invention generally relates to an axle assembly and more specifically to a tag axle assembly and a method of fabricating a tag axle assembly for a motor vehicle.

[2] Typically heavy trucks include driven tandem axles to support the weight of a towed trailer. Driven tandem axles are relatively complicated and expensive due to the need to drive each of the axles.

[3] In some vehicle configurations tandem axles are provided but only a single axle is driven. The tandem axles include a single driven axle connected by way of a main drive shaft to an engine of the truck. The non-driven axle, known in the art as a tag axle, may be disposed behind the driven axle to support a portion of the trailer weight. Tag axles are used in many different vehicle applications including large trucks towing cargo trailers and buses utilizing to rear axles.

[4] In some vehicle configurations it is desirable to position the driven axle to the rear of the non-driven axle to provide desired vehicle stability and handling characteristics. In such configurations the tag axle is disposed between the motor and the driven axle. Therefore, the tag axle includes a generally U shaped configuration to allow the drive shaft to extend to the driven axle. Tag axles include similar suspension and braking systems as compared to the driven axle.

[5] Loads exerted on a tag axle assembly can be relatively large, which may require robust fabrication techniques, which are often not cost efficient. Further, because a tag axle does not use an axle that extends across the vehicle frame, independent spindles are used at each end. The independent spindles may be difficult and time intensive to align and may require significant reinforcement.

[6] Current tag axle assemblies include a housing built from heavy-duty steel plate. Each spindle assembly is bolted to a torque plate. The torque plate is a separate plate bolted to the housing that provides for mounting of the spindle and brake assembly. The torque plate is secured to the housing assembly by a plurality of bolts. The connection between the torque plate and the housing is highly stressed and may require particular components that are relatively expensive to manufacture.

The use of special components increases costs and contributes to inconsistencies that can affect quality.

[7] Accordingly it is desirable to provide a tag axle assembly and method of construction that minimizes the use of expensive and complicated components.

SUMMARY OF INVENTION

[8] The present invention is a tag axle assembly for a motor vehicle that includes an integrally formed torque plate, and a method of fabricating a tag axle assembly using relatively uncomplicated components.

[9] The tag axle assembly of the present invention includes an axle housing constructed of rectangular plate members. A torque plate is attached as the end plate of the housing. The axle housing assembly includes the torque plate to eliminate the joint between the torque plate and the housing.

[10] The present invention also includes a method of fabricating a tag axle assembly using a standard axle assembly to align spindle assemblies on each side of the axle assembly. The axle assembly extends the entire width of the axle housing and is mounted to the open ends and bottom sections of the axle assembly. The axle assembly includes the spindle assemblies disposed at each end. The axle assembly and torque plate are welded to the axle housing. A center section of the axle assembly is then cut and removed. This method of mounting the spindle assemblies to the axle housing simplifies alignment of spindles during manufacture.

[11] Accordingly the tag axle assembly of this invention provides an assembly and method of construction that minimizes the use of expensive and complicated components.

BRIEF DESCRIPTION OF THE DRAWINGS

[12] The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:

[13] Figure 1 is a schematic view of a motor vehicle including a tag axle assembly;

[14] Figure 2 is a plane view of one end of a completed tag axle assembly including brake and hub assemblies;

[15] Figure 3 is a side view of the completed tag axle assembly;

[16] Figure 4 is a plane view of a tag axle assembly without the brake or hub assemblies;

[17] Figure 5 is a end view of the tag axle assembly and torque plate;

[18] Figure 6 is a prospective view of the housing of the tag axle assembly;

[19] Figure 7 is an end view of the housing of the tag axle assembly;

[20] Figure 8 is a plan view of the torque plate;

[21] Figure 9 is a plan view of the axle assembly according to this invention including the axle assembly before removal of a center portion;

[22] Figure 10 is a plan view of the tag axle assembly of this invention after removal of the axle assembly center portion; and

[23] Figure 11 is a flow diagram illustrating the steps of fabricating the tag axle assembly according to this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[24] Referring to Figure 1, a motor vehicle 10 includes a front axle and tandem rear axles. Typically, the two rear axles at least partially support the load of a trailer (not shown). An engine 18 rotates a drive shaft 16 that drives a driven axle 14 disposed adjacent a rearward segment of the motor vehicle 10. The vehicle 10 includes a non-driven tag axle assembly 12 disposed between the engine 18 and the driven axle 14. Because the tag axle assembly 12 is disposed between the driven axle 14 and the motor 18 the drive shaft 16 must extend through or under the tag axle assembly 12.

[25] Referring to Figure 2, a first segment 36 of the tag axle assembly 12 includes a housing 20 supporting a spindle assembly 46. The spindle assembly 46 is welded to the axle housing 20 at weld 58. Attached to the axle housing 20 and mounted to a torque plate 50 are a brake assembly 22 and hub assembly 24. The brake assembly 22 and hub assembly 24 are as known to a worker skilled in the art. It is within the contemplation of this invention that any configuration brake assembly and hub

assembly known to a worker skilled in the art can be used and is dependent only on the application's specific requirements.

[26] Referring to Figure 3, the housing 20 includes a front plate 28 and a rear plate 30. The front plate 28 and rear plate 30 are attached to each other and spaced a distance apart by a top plate 26. The top plate 26 extends between the front and back plates 20,30 to form the generally rectangular housing 20. The rectangular housing 20 includes an overall inverted U-shaped configuration. The inverted U-shaped configuration of the axle housing 20 provides for the drive shaft 16 to extend between the motor 18 and driven axle 14.

[27] Referring to Figure 4, the tag axle assembly 12 is shown without the brake assembly 22 and hub assembly 24 to provide further clarity on the construction of the housing 20. The housing 20 includes the front and rear plates 28,30 and also includes the torque plate 50. The torque plate 50 is preferably an integral portion of the housing 20 and provides for the mounting of the braking assembly 22. The torque plate 50 is welded in place with at least a portion of the thickness of the torque plate 50 disposed within a space defined between the front and rear plates 28, 30.

[28] The torque plate 50 includes a central opening 54. The central opening 54 provides for the spindle assembly 46 to extend there through. A spindle housing 48 of the spindle assembly 46 is attached to the housing 20. The spindle housing 48 becomes the bottom portion of the axle housing 20. The torque plate 50 includes flanges 52 for mounting of the brake assembly 22. Each of the flanges 52 includes openings 56 for brake assembly fasteners. The openings 56 may be threaded to correspond to threads of the fasteners used to mount the brake assembly 22.

[29] Referring to Figures 6-8, construction of the axle housing 20 includes the attaching of the front plate 28 to a top plate 26 and a back plate 30 also attached to the top plate 26. A bottom plate 32 is disposed to cover areas that are not covered by the spindle assembly 46. The bottom plate 32 is welded between the front and back plates 28,30. The axle housing 20 in a semi-assembled position includes an open end 66 for receiving the torque plate 50. The axle housing 20 also includes an open bottom portion 68 for receiving the spindle assemblies 46.

[30] Referring to Figures 9 and 10, a portion of the final assembly of the tag axle assembly 12 is shown. Figure 9 shows the tubular axle assembly 42 and the axle housing 20. The spindle assembly 46 is preferably a portion of an existing standard axle assembly 40. The axle assembly 40 includes spindle assemblies 46 at each end, but only a hollow tubular member extending therebetween. The use of an existing standard axle assembly 40 common to those already used for trailer applications decreases the expense and eliminates special fabrication of parts for the tag axle assembly 12.

[31] Welds 58 and 60 secure the axle assembly 40 and torque plate 50 to the axle housing 20. As is shown in Figure 9, at this stage in assembly the entire tubular axle housing 40 is attached to the axle housing 20. Using the entire axle assembly 40 provides for alignment of each of the spindle assemblies 46 relative to each other with minimal gauging and/or fixturing. After attachment of the torque plate 50 and the axle assembly 40 to the axle housing 20 a center portion 62 of the axle assembly 40 is removed to provide the final overall inverted U-shape of the tag axle assembly 12.

[32] Integration of the torque plate 50 with the axle housing 20 minimizes complicated highly stressed and expensive mounting and fasteners. Further, the alignment provided by the use of the axle assembly 40 decreases expense and improves manufacturing efficiency.

[33] Referring to Figure 11, a method of this invention includes the steps of fabricating an axle housing 20 by attaching a front and back sheet of material to a top sheet and a bottom sheet to form a generally rectangular axle housing and cross section. The axle housing includes an inverted U-shape to provide for the drive shaft 16 to extend between the motor and driven axle at the rear of the vehicle 10. The axle assembly 40 is provided and the torque plate 50 is attached to each end of the axle assembly 40.

[34] The axle housing 20 and the axle assembly 40 that includes both torque plates 50 and spindle housing assemblies 47 at each end are then combined into one intermediate assembly. The axle assembly 40 is welded to the axle housing 20. The torque plate 50 is welded to the axle housing 20.

[35] The method also includes the steps of aligning the spindle assemblies 46 at each end of the axle housing 20 by way of the axle assembly 40. Alignment of the torque plates 50 and spindle assembly 46 relative to each other is simplified by the attachment of the single axle assembly 40 that extends from the first and second ends of the axle housing 20. Upon completion of the welding of the torque plate 50 and spindle housing 46 to the axle housing 20 the center portion of the axle assembly 40 is removed. The center portion 62 is removed to provide the overall configuration desired for the completed axle housing assembly 12.

[36] After completion of the axle housing assembly 12, the inner ends 72 of the spindle housings 48 are sealed and the overall shape of the axle housing 12 is complete.

[37] This method includes the torque plate 50 forming an end segment of the axle assembly 40 to minimize inefficient and highly stressed joints previously required to support spindle assemblies at each end of axle housing. In addition, the axle assembly is used to align each of the spindle assemblies at distal segments of the housing. The alignment function of the tubular axle assembly eliminates inefficient and relatively costly fixturing and manufacturing steps. The complete axle housing assembly includes improved alignment between spindle assemblies disposed on each end of the axle housing and a strengthened joint without highly stressed fasteners.

[38] The non driven axle assembly of this invention provides improvements over prior art axle assemblies by eliminating a highly stressed joint and providing improved alignment between spindle assemblies disposed on each end of the axle housing. These improvements also provide for improved manufacturing efficiencies by using standard parts such as the tubular axle assembly instead of relatively costly custom fabricated parts.

[39] The foregoing description is exemplary and not just a material specification. The invention has been described in an illustrative manner, and should be understood that the terminology used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed, however, one of ordinary skill

in the art would recognize that certain modifications are within the scope of this invention. It is understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. For that reason the following claims should be studied to determine the true scope and content of this invention.